

FIG. 1

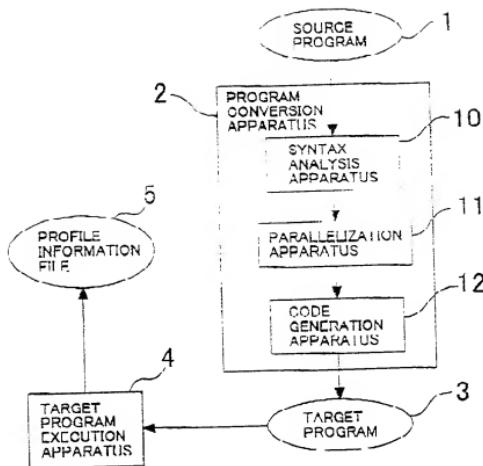


FIG. 2

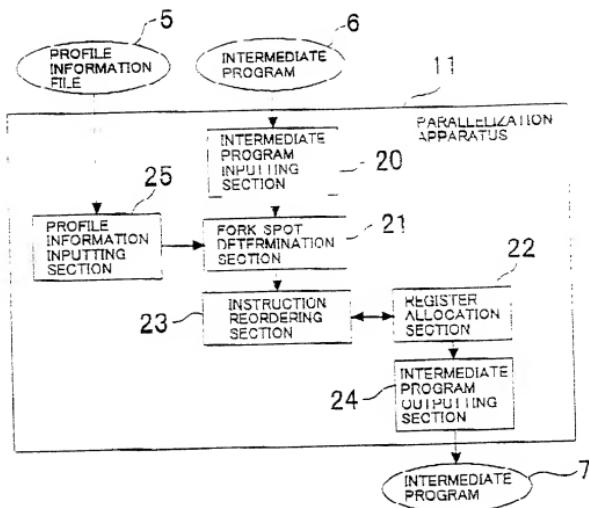


FIG. 3

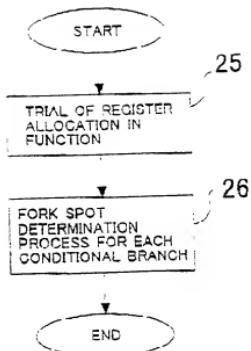


FIG. 4

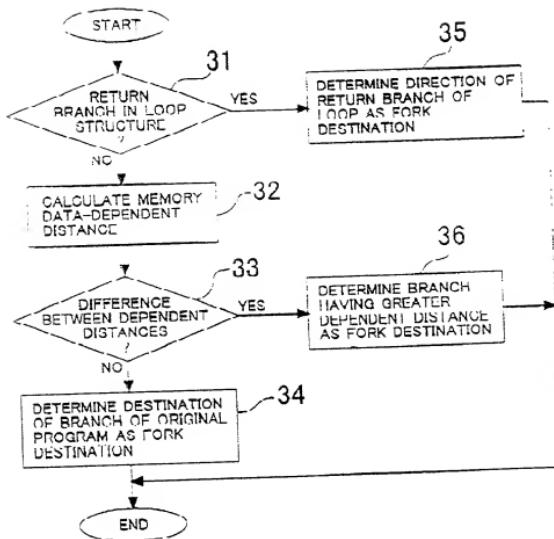
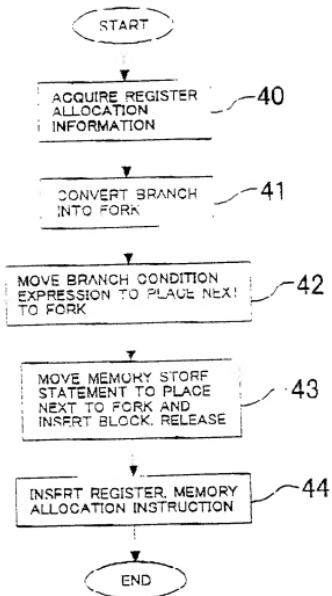


FIG. 5



00024444 0322404

FIG. 6(A)

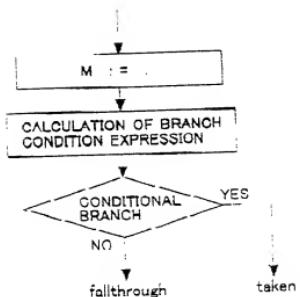


FIG. 6(B)

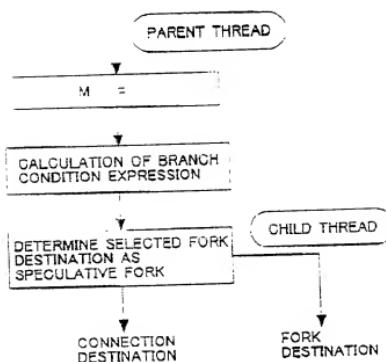


FIG. 6(C)

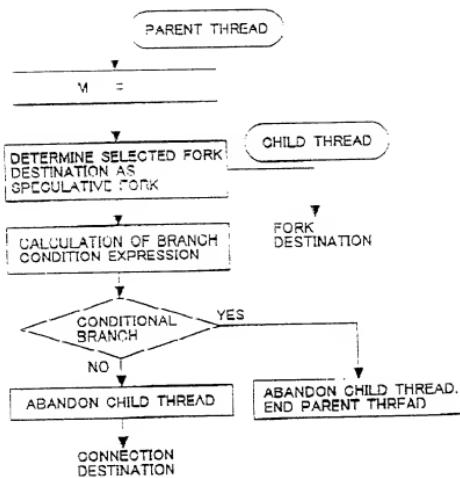


FIG. 6(D)

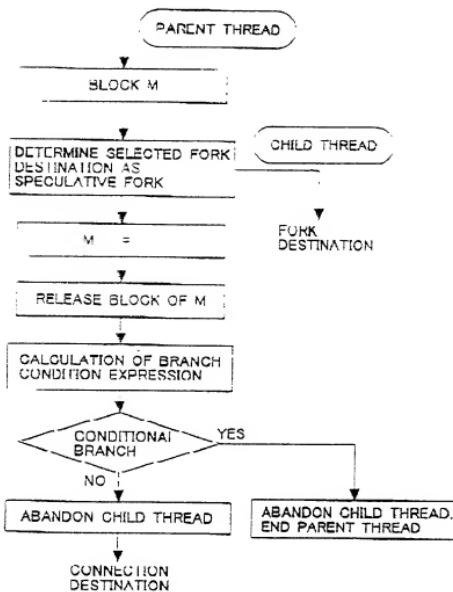


FIG. 6(E)

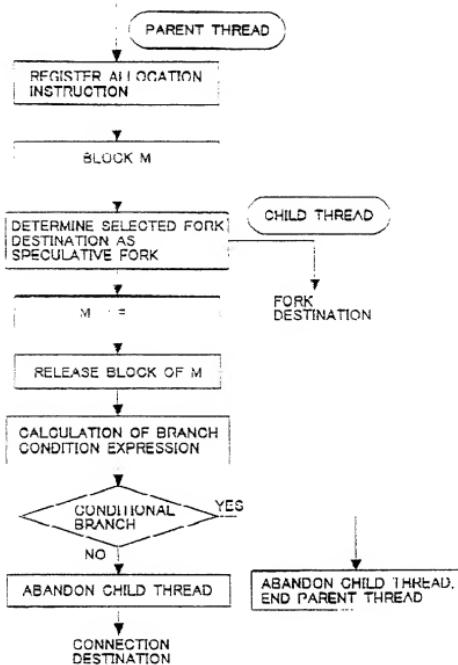


FIG. 7

SFORK 1	
TO CREATE A SPECULATION MODE CHILD THREAD FOR STARTING EXECUTION FROM 1	
TTERM c	TO END SELF THREAD AND SETTLE CHILD THREAD IF C IS TRUE
FTERM c	TO END SELF THREAD AND SETTLE CHILD THREAD IF C IS FALSE
THABORT	TO ABANDON A CHILD THREAD OF A SPECULATION MODE
BLACK m	TO DESIGNATE A MEMORY ADDRESS DESIGNATED WITH M AS BLOCK
RELEASE m	TO CLEAR BLOCK SET TO MEMORY ADDRESS DESIGNATED WITH M
DSPIN	TO CREATE A CHILD THREAD CREATED BY SUCCEEDING FORK IN DATA-DEPENDENT SPECULATION MODE
DSPOUT	TO CLEAR DATA-DEPENDENT SPECULATION MODE OF CHILD THREAD
RDCL t . . .	TO INSTRUCT TO ALLOCATE INTERMEDIATE TERMS/ VARIABLES DESIGNATED WITH t . . . TO REGISTER
MDCL t . . .	TO INSTRUCT TO ALLOCATE INTERMEDIATE TERMS/ VARIABLES DESIGNATED WITH t . . . TO MEMORY

FIG. 8

```

(1) t1 := &X
(2) t2 := !
(3) t3 := 4
(4) t4 := t2 * t3
(5) t5 := t1 - t4
(6) t6 := !
(7) mem(S) := t6
(8) t7 := !
(9) t8 := 20
(10) t9 := t7 > t6
(11) if false then goto L2
(12) L1:
(13) t10 := &X
(14) t11 := !
(15) t12 := 4
(16) t13 := t11 * t12
(17) t14 := t10 + t13
(18) t15 := mem(t14)
(19) t16 := J
(20) t17 := t15 - t16
(21) R := t17
(22) goto L3
(23) L2:
(24) t18 := K
(25) t19 := 10
(26) t20 := t10 + t19
(27) R := t20
(28) t21 := &X
(29) t22 := J
(30) t23 := 4
(31) t24 := t22 * t23
(32) t25 := t21 + t24
(33) t26 := mem(t25)
(34) t27 := R
(35) t28 := t26 - t27
(36) R := t28
(37) L3:

```

FIG. 9

```
(51) t1 := &X
(52) t2 := I
(53) t3 := 4
(54) t4 := t2 + t3
(55) t5 := t1 + t4
(56) t6 := 1
(57) mem(t5) := t6
(58) SPFORK L2
(59)
(60) t7 := I
(61) t8 := 20
(62) t9 := t7 > t8
(63) FTERM
(64) IHABORT
(65) L1:
(66) t10 := &X
(67) t11 := J
(68) t12 := 4
(69) t13 := t11 * t12
(70) t14 := t10 + t13
(71) t15 := mem(t14)
(72) t16 := J
(73) t17 := t15 + t16
(74) R := t17
(75) goto L3
(76) |?
(77) t18 := K
(78) t19 := 10
(79) t20 := t18 / t19
(80) R := t20
(81) t21 := &X
(82) t22 := J
(83) t23 := 4
(84) t24 := t22 * t23
(85) t25 := t21 + t24
(86) t26 := mem(t25)
(87) t27 := R
(88) t28 := t26 + t27
(89) R := t28
(90) L3:
```

FIG. 10

```
(101) t1 := &X
(102) t2 := 1
(103) t3 := 4
(104) t4 := t2 + t3
(105) t5 := t1 + t4
(106) BLOCK t5
(107) SPORK L2
(108) t6 := 1
(109) mem(t5) := t6
(110) RELEASE t6
(111) t7 := 1
(112) t8 := 20
(113) t9 := t7 > t8
(114) FTERM
(115) THABORT
(116) goto L1
(117) L1:
(118) t10 := &X
(119) t11 := 3
(120) t12 := 4
(121) t13 := t11 * t12
(122) t14 := t10 + t13
(123) t15 := mem(t14)
(124) t16 := t15 + t16
(125) t17 := t15 + t16
(126) R := t17
(127) goto L3
(128) L2:
(129) t18 := K
(130) t19 := 10
(131) t20 := t18 / t19
(132) R := t20
(133) t21 := &X
(134) t22 := J
(135) t23 := 4
(136) t24 := t22 + t23
(137) t25 := t21 + t24
(138) t26 := mem(t25)
(139) t27 := R
(140) t28 := t26 + t27
(141) R := t28
(142) L3 :
```

} (B1)

} (B2)

} (B3)

FIG. 11

```

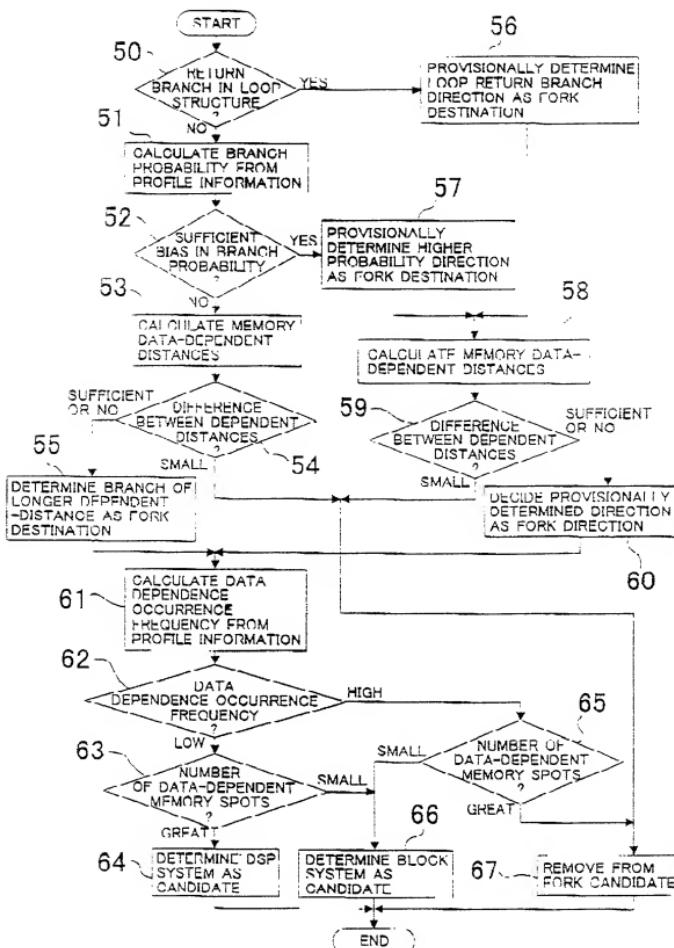
(201) RDCL t1 = t9
(202) RDCL I
(203) MDCL X
(204) t1 = &X
(205) t2 = I
(206) t3 = 4
(207) t4 = t2 + t3
(208) t5 = +1 + t4
(209) BLOCK t5
(210) SPORK L2
(211) t6 = :
(212) mem(t5) = t6
(213) RELEASE t5
(214) t7 = :
(215) t8 = 20
(216) t9 = -7 > +8
(217) FTERM
(218) THABORT
(219) goto L1
(220) L1:
(221) RDCL t10 = t17
(222) RDCL R
(223) MDCL X, J
(224) t10 = &X
(225) t11 = J
(226) t12 = 4
(227) t13 = t11 * t12
(228) t14 = t10 + t13
(229) t15 = mem(t14)
(230) t16 = J
(231) t17 = t15 + t16
(232) R = t17
(233) goto L3
(234) L2:
(235) RDCL t18 = t28
(236) RDCL R
(237) MDCL X, J
(238) t18 = K
(239) t19 = 10
(240) t20 = t18 / t19
(241) R = t20
(242) t21 = &X
(243) t22 = J
(244) t23 = 4
(245) t24 = t22 * t23
(246) t25 = t21 + t24
(247) t26 = mem(t25)
(248) t27 = R
(249) t28 = t26 + t27
(250) R = t28
(251) L3:

```

FIG. 12

```
(255) r21 := &X
(256) r22 := r11
(257) r23 := 4
(258) r24 := r22 * r23
(259) r25 := r21 + r24
(260) BLOCK r25
(261) SPFORK L2
(262) r26 := 1
(263) mem(r25) = r26
(264) RELEASE r25
(265) r27 := r11
(266) r28 := r20
(267) r29 := r27 * r28
(268) FTERM r29
(269) THABORT
(270) goto L1
(271) L1:
(272) r20 := &X
(273) r21 := mem(&J)
(274) r22 := 4
(275) r23 := r21 + r22
(276) r24 := r20 + r23
(277) r25 := mem(r24)
(278) r26 := mem(&J)
(279) r27 := r25 + r26
(280) r12 := r27
(281) goto L3
(282) L2:
(283) r20 := r13
(284) r21 := 10
(285) r22 := r20 / r21
(286) r12 := r22
(287) r23 := &X
(288) r24 := mem(&J)
(289) r25 := 1
(290) r26 := r24 * r25
(291) r27 := r23 + r26
(292) r28 := mem(r27)
(293) r29 := r12
(294) r30 := r28 + r29
(295) r12 := r30
(296) L3:
```

FIG. 13



TOP SECRET//SI//REL TO USA, FVEY, FVEY, FVEY

FIG. 14

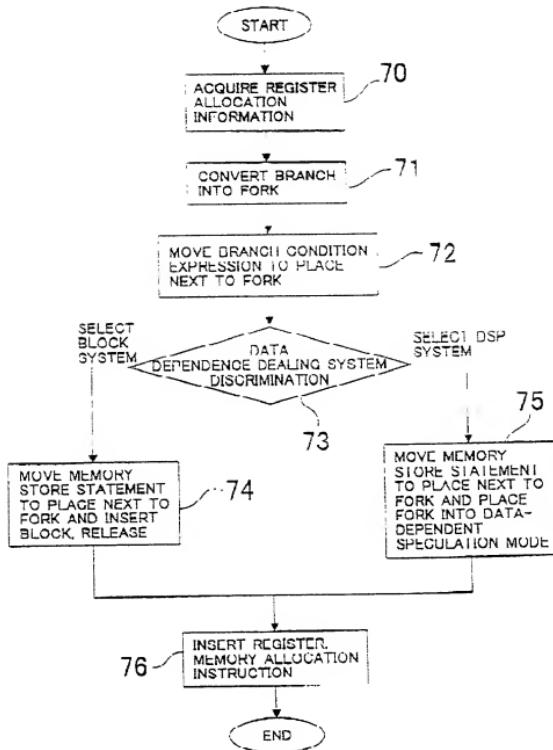


FIG. 15

```

t1 := P
t2 := 0
t3 := t1 < t2
if false goto L2
L1:
    t4 := 0
    o := t4
    } (B11)
L2:
    t5 := P
    t6 := 15
    t7 := t5 > t6
    if false goto L4
L3:
    t8 := 0
    o := t8
    } (B12)
L4:
    t9 := 1
    t10 := P
    t11 := t9 << t10
    j := t11
    c12 := 2
    mem(t12) := t11
    t13 := &X
    t14 := 0
    t15 := 4
    t16 := t14 * t15
    t17 := t13 + t16
    *18 := mem(t17)
    t19 := j
    t20 := t18 + t19
    mem(t17) := t20
    K := t20
    t21 := &X
    t22 := 1
    t23 := 4
    t24 := t22 * t23
    t25 := t21 + t24
    t25 := mem(t25)
    t27 := 0
    t28 := t28 > t27
    if false goto L6
L5:
    t29 := &X
    t30 := P
    t31 := 4
    t32 := t30 * t31
    t33 := t29 + t32
    t34 := mem(t33)
    t35 := 1
    t36 := t34 - t35
    mem(t33) := t36
    } (B16)
L6:
    t37 := &Y
    t38 := P
    t39 := 4
    t40 := t38 * t39
    t41 := t37 + t40
    t42 := mem(t41)
    t43 := K
    t44 := t42 + t43
    j := t44
    } (B17)
  
```

FIG. 16(A)

BRANCHING NUMBER		
R 11	R 12- 2D	R 13- 18D
R 13	R 14- 3D	R 15- 17D
B 15	B 16- 3D	B 17- 17D

FIG. 16(B)

MEMORY DATA DEPENDENCE

B 15 $\rightarrow$ B 16	12D
B 15 $\rightarrow$ R 17	4

FIG. 17

FIG. 18

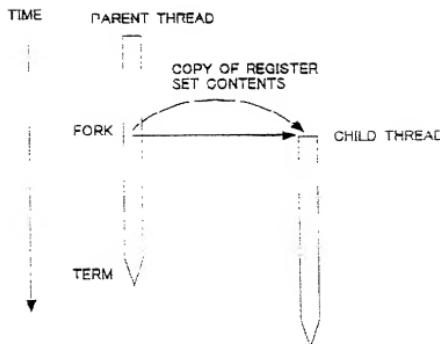


FIG. 19

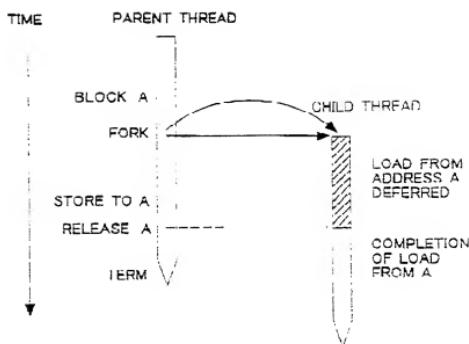


FIG. 20(A)

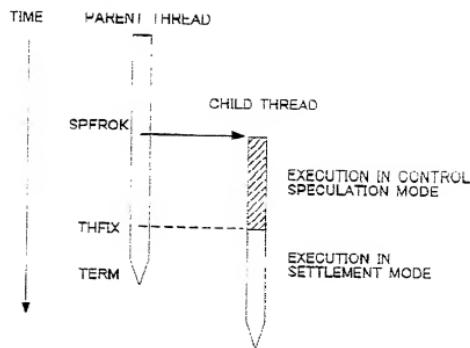


FIG. 20(B)

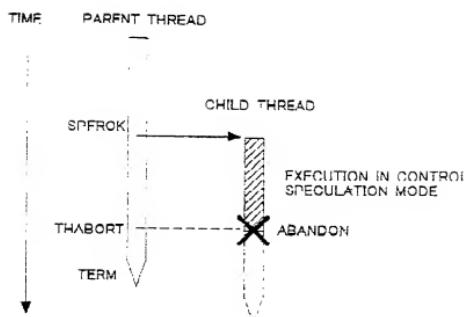


FIG. 21

